

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YYYY) 09/14/2017		2. REPORT TYPE Abstract		3. DATES COVERED (From - To)	
4. TITLE AND SUBTITLE Effect of High-Speed Sintering on the Properties of Zirconia-Oxide Materials				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) McKinley D Soult				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) 59th Clinical Research Division 1100 Willford Hall Loop, Bldg 4430 JB SA-Lackland, TX 78236-9908 210-292-7141				8. PERFORMING ORGANIZATION REPORT NUMBER 17398	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) 59th Clinical Research Division 1100 Willford Hall Loop, Bldg 4430 JB SA-Lackland, TX 78236-9908 210-292-7141				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.					
13. SUPPLEMENTARY NOTES Journal of Dental Research					
14. ABSTRACT Effect of High-Speed Sintering on the Properties of Zirconia-Oxide Materials Soult MD, Lien W, Gallardo FF, Vandewalle KS Digital dentistry has led to the popular success of same-day single crown delivery. However, traditional fabrication of zirconia materials typically requires several hours of sintering. A new sintering furnace is available that reportedly sinters zirconia in minutes versus hours. Limited research has been published evaluating the effect of high-speed sintering on the properties of zirconia. Objective: The purpose of this study was to compare the mechanical properties and translucency of CEREC Zirconia (Dentsply/Sirona) sintered using the CEREC SpeedFire high-speed sintering furnace (Dentsply/Sirona) for 30 minutes and Programat 1600 S1 (Ivoclar Vivadent) for 4.3 hours. Methods: Beam-shaped specimens were designed using an Omnicam (Version 4.4.4; Dentsply/Sirona) and milled from CAD/CAM blocks using a MCXL milling unit (Dentsply/Sirona), po					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Clarice Longoria
					19b. TELEPHONE NUMBER (Include area code) 210-292-7141

Effect of High-Speed Sintering on the Properties of Zirconia-Oxide Materials

Soult MD, Lien W, Gallardo FF, Vandewalle KS

Digital dentistry has led to the popular success of same-day single crown delivery. However, traditional fabrication of zirconia materials typically requires several hours of sintering. A new sintering furnace is available that reportedly sinters zirconia in minutes versus hours. Limited research has been published evaluating the effect of high-speed sintering on the properties of zirconia. **Objective:** The purpose of this study was to compare the mechanical properties and translucency of CEREC Zirconia (Dentsply/Sirona) sintered using the CEREC SpeedFire high-speed sintering furnace (Dentsply/Sirona) for 30 minutes and Programat 1600 S1 (Ivoclar Vivadent) for 4.3 hours. **Methods:** Beam-shaped specimens were designed using an Omnicam (Version 4.4.4; Dentsply/Sirona) and milled from CAD/CAM blocks using a MCXL milling unit (Dentsply/Sirona), polished, and sintered using the CEREC SpeedFire furnace or the Programat 1600 S1 for the CEREC Zirconia. The properties of the zirconia were also compared to a lithium-disilicate material, IPS e.max CAD (Ivoclar Vivadent). IPS e.max CAD beams were crystallized in the CEREC SpeedFire furnace or Programat P500. Flexural strength and modulus were determined by subjecting the beams (4 x 1.3 x 18mm) to a three-point bend test in a universal testing machine (Instron). Translucency Parameter and Opalescence Parameter were calculated using a spectrophotometer (VITA Easysshade, Vident) that measured L*, a*, and b* values. A mean and standard deviation was determined per group. Data were analyzed with a two-way ANOVA/Tukey's and unpaired t-tests ($\alpha=0.05$). **Results:** No significant differences were found for any of the properties tested between the furnaces for both of the ceramic materials ($p>0.05$). CEREC Zirconia had significantly greater flexural strength than IPS e.max CAD, but had significantly less Translucency Parameter and Opalescence Parameter. **Conclusions:** The SpeedFire furnace was capable of sintering the zirconia beams in significantly less time than with the Programat S1 furnace with no significant change in properties.

Material	Property	SpeedFire (30 mins)	Programat S1 (4.3 hrs)
CEREC Zirconia	Flexural Strength (MPa)	966.1 (194.5) A	982.6 (177.9) A
	Flexural Modulus (GPa)	206.9 (22.8) A	196.1 (24.0) A
	Translucency Parameter	15.8 (2.2) A	14.9 (1.9) A
	Opalescence Parameter	10.1 (1.5) A	8.9 (0.9) A
		SpeedFire (24 mins)	Programat P500 (26.8 mins)
IPS e.max CAD	Flexural Strength (MPa)	388.7 (52.6) A	318.2 (52.6) A
	Flexural Modulus (GPa)	116.8 (7.4) A	121.8 (4.9) A
	Translucency Parameter	20.3 (1.2) A	20.7 (1.1) A
	Opalescence Parameter	11.5 (0.8) A	11.5 (1.1) A
Groups with the same letter per row are not significantly different ($p>0.05$)			

The views expressed in this study are those of the authors and do not reflect the official policy of the United States Air Force, the Department of Defense, the Uniformed Services University of the Health Sciences or the United States Government. The authors do not have any financial interest in the companies whose materials are discussed in this abstract.